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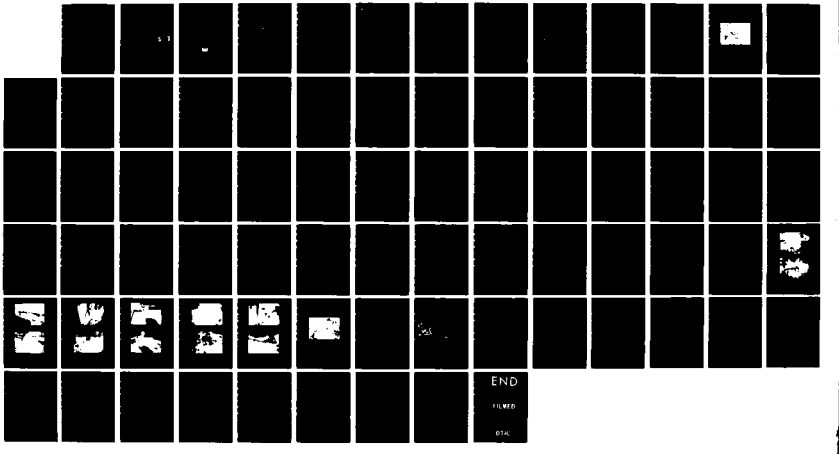

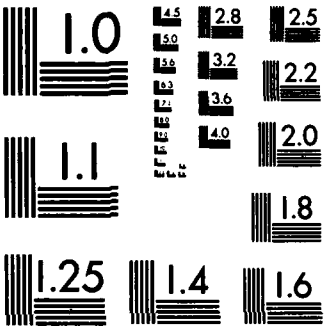

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MERRIMACK RIVER BASIN
DEERFIELD, NEW HAMPSHIRE

PLEASANT LAKE DAM
NH 00179

STATE NO 61.01

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JULY 1978

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Merrimack River Basin
Deerfield, New Hampshire
Tributary of Little Suncook Rivr

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

TTe dam is about 11 ft. high, and is about 1180 ft. long. The dam is in fair condition. It has an inadequate spillway discharge capacity. The stopleg spillway weir will pas 85 cfs, or about 4 percent of the test flood. There are various items which should be implemented by the owner.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

Honorable Meldrim Thomson, Jr.
Governor of the State of
New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Thomson:

I am forwarding to you a copy of the Pleasant Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, the Town of Deerfield, Water Commission, Deerfield New Hampshire 03037.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

PLEASANT LAKE DAM

NH 00179

MERRIMACK RIVER BASIN
DEERFIELD, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	NH00179
Name of Dam:	Pleasant Lake Dam
Town:	Deerfield
County and State:	Rockingham County, New Hampshire
Stream:	Tributary of Little Suncook River
Date of Inspection:	31 May 1978

BRIEF ASSESSMENT

Pleasant Lake Dam is about 11 feet high, averages about 30 feet wide, and is about 1,180 feet long. It is a composite dam consisting of a 121-foot concrete wall near the west abutment that is tied to earthen sections. It has a vertical-drop stoplog spillway 3 feet by 5½ feet. Below the stoplog spillway is a 3'-9" x 3' gate. The gate has been buried for many years; the mechanism for its operation has been removed. Maximum storage capacity is about 4,200 acre-feet. Pleasant Lake, used now for recreational purposes, is nearly 2 miles long and has a surface of about 450 acres.

The dam is in fair condition. It has an inadequate spillway discharge capacity. Seepage of 1 cfs was noted at the toe along both sides of the concrete spillway abutments. Cracks in the concrete wall and spalling were noted. The inability to raise the gate prevents drainage of the lake without breaching the dam.

The stoplog spillway weir will pass 85 cfs, or about 4 percent of the test flood. The test flood would overtop the dam by 2 feet.

The owner, the Town of Deerfield, within two years, should retain the services of a registered professional engineer and implement the results of his evaluation of the following: Assess further the potential for overtopping and the inadequacy of the spillway, design the remedial measures needed to eliminate the seepage around the spillway abutments, and provide a non-destructive means to safely drain the lake. Within one year, the owner should implement the following operating & maintenance measures: Monitor seepages weekly, replace rotten timbers, keep debris from the spillway, clear brush between the spillway and road, and establish a surveillance and warning program to be exercised during floods.

Warren A. Guinan

Warren A. Guinan
Project Manager
N. H. P. E. No. 2339

This Phase I Inspection Report on the Pleasant Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

SEP 1

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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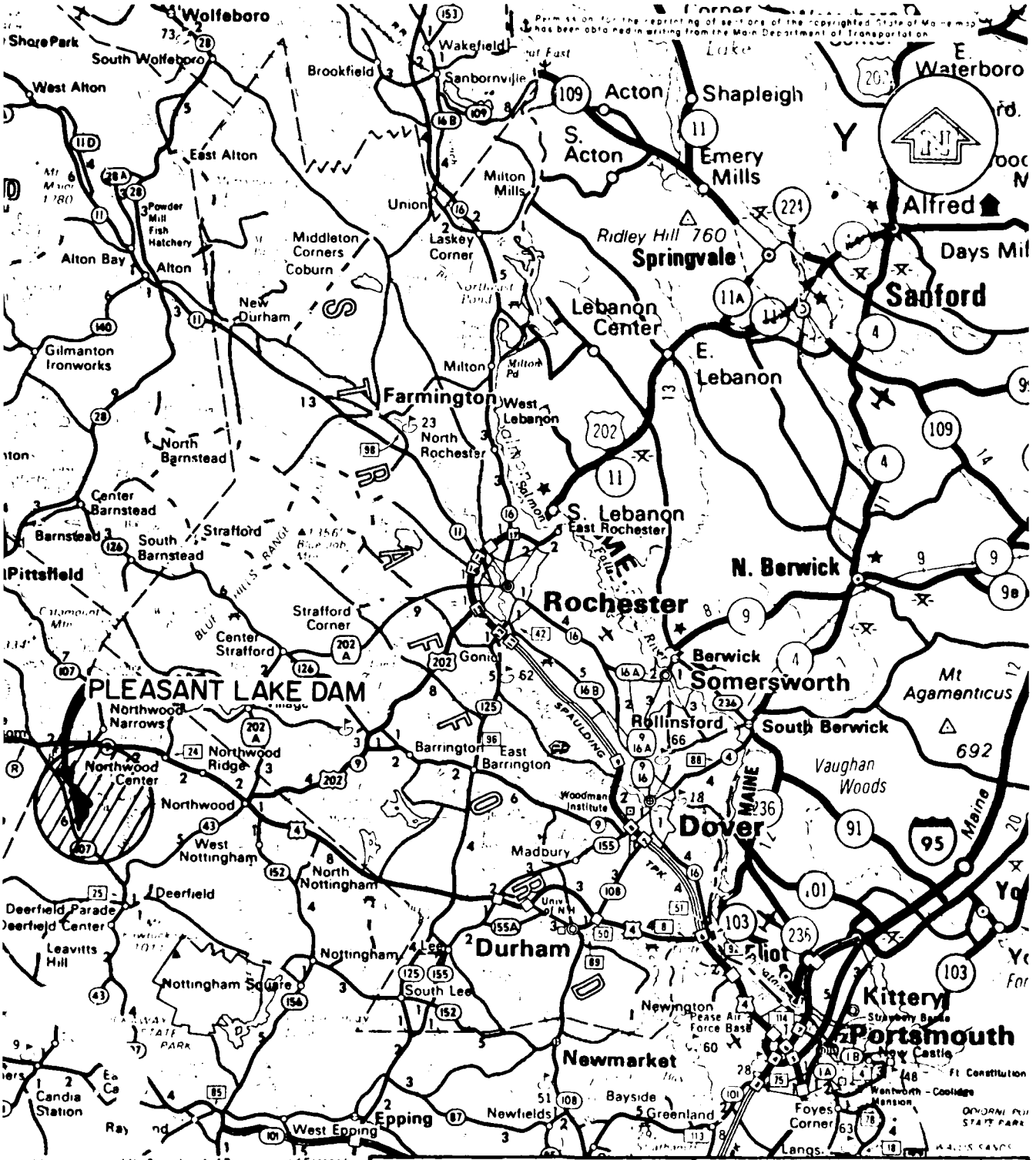
REPORT

APPENDICES

Figure 1 - Overview of upstream face of outlet structure and earthen embankment.



SCALE IN MILES

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AP BASED ON STATE OF NEW HAMPSHIRE - TATE OF MAINE OFFICIAL HIGHWAY MAPS

U.S. ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PLEASANT LAKE DAM
LOCATION MAP

PLEASANT LAKE — NEW HAMPSHIRE

SCALE 1" = 5Mi

DATE JULY 1978

SECTION 7
ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual inspection indicates that the Pleasant Lake Dam is in fair condition. The major concerns with regard to the overall integrity of the dam are as follows:

(1) The inadequacy of the spillway,

(2) The seepage taking place along the spillway abutments,

(3) The general deteriorated condition of the concrete, stoplog guides, wood deck, and possibly the stoplogs and gate, and

(4) The inability to drain the lake.

Although the hydraulic analysis reveals that the dam will be overtopped by one-half the test flood, the spillway capacity is not considered seriously inadequate because no high hazard to loss of life from large flows downstream of the dam is likely with present development.

Because the wooden gate can no longer be raised and its condition cannot be determined, it cannot be used to drain the lake should this be required. Even if it could be raised, the elevation of the downstream culverts is too high to allow the lake to be drained. Water would be impounded between the spillway and the roadway to the elevation of the culvert inverts. As long as the gate remains submerged in water and sediment, the wood should not deteriorate further, and, if bolted, or strapped, it should remain relatively intact. However, its condition at the time of last lowering is uncertain. At present, breaching of the dam to drain the lake would require severance of the access road.

b. Adequacy of Information. The information available is such that the assessment of the condition of the dam must be based on the visual inspection.

c. Urgency. The recommended remedial measures enumerated in 7.2 below should be implemented within two years.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation.

(1) Embankment. Visual observation did not indicate any existing structural problems in the dam embankment. Concentrated seepage and localized erosion was observed at the contact between the dam embankment and the concrete spillway abutments. (See Section 3.1b.)

(2) Appurtenant Structures. Visual inspection of the concrete wingwalls and spillway section did not reveal any evidence of instability. However, the concrete has deteriorated since original placement. (See Section 3.1c.)

b. Design and Construction Data. No design and construction data were disclosed.

c. Operating Records. No operating records were disclosed.

d. Post-Construction Changes. According to an inspection report dated December 21, 1949, a large section of the dam had been breached. No other information about the breaching or its repair is available. This report also noted the abutments to be in "very poor" condition. (See Appendix B.) No records of construction changes, maintenance or repair were found.

e. Seismic Stability. This dam is in Seismic Zone 2 and hence does not have to be evaluated for seismic stability according to the OCE Recommended Guidelines.

d. Overtopping Potential. The dam is unable to pass the test flood without overtopping. The water depth over the lowest point in the roadway was calculated to be about 2 feet for this flood. In fact, the spillway capacity is only 4 percent of the test flood discharge.

SECTION 5
HYDROLOGY AND HYDRAULIC ANALYSIS

5.1 Evaluation of Features

a. Design Data. No hydrologic or hydraulic design data were disclosed for Pleasant Lake Dam.

Pleasant Lake Dam is classified as being intermediate in size having a maximum storage of 4,215 acre-feet.

To determine the hazard classification for Pleasant Lake Dam, the impact of failure of the dam at maximum pool was assessed using Guidance for Estimating Downstream Dam Failure Hydrographs issued by the Corps of Engineers. The analysis covered the reach extending from the dam to Northwood Lake. Failure of Pleasant Lake Dam at maximum pool would probably result in an increase in stage of 5.6 feet along the reach. An increase in water depth of this magnitude would probably result in the loss of less than 10 lives, sever the road just downstream of the dam, and might destroy one or two houses. The volume of water entering Northwood Lake may significantly increase the stage at Northwood Lake Dam.

As a result of the analysis described above, Pleasant Lake Dam was classified-Significant Hazard. Using OCE Recommended Guidelines for Safety Inspection of Dams, the recommended spillway test flood is the Probable Maximum Flood (PMF). The test flood discharge for Pleasant Lake Dam, having a drainage area of 3.6 square miles, was determined to be 2050 cfs.

b. Experience Data. An interview with a resident revealed that water had overtopped portions of the embankment during the flood of 1938. According to a 1949 inspection report, a "large section (of the embankment) was breached and flows over road at times." (See Appendix B.) A 1939 report does not mention breaching or overtopping. The 1949 report does not indicate the year that this breaching occurred; therefore one may infer that overtopping has occurred at least twice and the breaching occurred sometime between July 1939 and December 1949; probably the breaching occurred in 1949.

c. Visual Observations. No evidence of damage to any portion of the project from overtopping was visible at the time of the inspection.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

No written operational procedures were disclosed for Pleasant Lake Dam and Reservoir. The current dam operator is guided by his "good judgment." He attempts to keep the water level as high as possible during the summer recreational season. After each July 4th weekend, the lake level is dropped approximately 1 inch per week until Labor Day, lowering the stoplogs approximately a total of 18-20 inches. These releases are made to dissipate scum and oil slicks from the surface that are the result of heavy motorboat usage of the lake. The sand sedimentation which builds up over the year is removed from the outlet channel by the flowing water. At the end of the summer season, sand remaining at the spillway inlet channel is removed by hand shoveling.

4.2 Maintenance of Dam

Pleasant Lake Dam is maintained by the Town of Deerfield, New Hampshire.

4.3 Maintenance of Operating Facilities

No written maintenance procedures were disclosed for Pleasant Lake Dam. The dam operator reports that to the best of his knowledge the gate has not been used for many years and is not now operable. A 1949 inspection report reflects that the gate was inoperable then. (See Appendix B.)

4.4 Description of Any Warning System in Effect

No written warning system was disclosed for Pleasant Lake Dam.

4.5 Evaluation

The current operation and maintenance procedures for Pleasant Lake Dam are inadequate to insure that all problems encountered can be remedied within a reasonable period of time. The owner should establish a written operation and maintenance procedure as well as establishing a warning system to follow in event of floodflow conditions or imminent dam failure.

3.2 Evaluation

The observed condition of the project is fair. The potential problems observed during the visual inspection are listed as follows:

(a) Concentrated seepage at the base of the spillway abutments.

(b) Deteriorated condition of the concrete wingwalls.

(c) Weathered condition of the wood deck and the unknown condition of the stoplogs and wooden gate.

(d) Inability to drain the pond because of the high inverts of the downstream culvert pipes and the inoperable gate.

Because the dam is low and has a wide crest, the stability of the dam embankment does not appear to be a problem. The existing trees at the shoreline lend to protecting the exposed face from serious erosion. From a hydraulic standpoint, the existing spillway and downstream culverts are able to pass only limited flows.

The normal pool elevation is only a few feet below the top of the dam. The dam may be subject to overtopping during periods of high flow and/or high winds.

is limited to a depth of 2 inches, exposing the reinforcing steel.

(2) The vertical-drop spillway is formed by two concrete abutments, with removable wood stoplogs creating the weir. (See Appendix C - Figures 5,6, and 7.) Because of the flow over the stoplogs, the condition of the stoplogs could not be determined. The gate located below the stoplogs was buried in sand and therefore was not visible. Each abutment is cracked in the vicinity of the intersection with the wingwalls. (See Appendix C - Figures 8 and 9.) About one-half inch of separation has occurred at the crack between the left abutment and wingwall. (See Appendix C - Figure 10.)

(3) The top of the spillway structure is covered with wood planking. The wood planking has not been painted and is badly weathered. (See Appendix C - Figure 8.) The wood deck has deteriorated sufficiently to pose a potential hazard to pedestrian loads.

Concentrated seepage estimated to be about 1 cfs was discharging from the soil at each side of the base of the abutments of the spillway. The discharge water was clear. Some soil has been eroded next to these abutments. (See Appendix C - Figures 11 and 12.)

Approximately 11 feet downstream of the spillway structure, two elliptical corrugated metal culverts (30" x 18"), 28.5 feet long, pass the discharge flow under the roadway. (See Appendix C - Figure 13.) Visual observation indicates the culverts have deteriorated; however, they continue to support highway loads. At the time of the inspection the culverts were flowing approximately 1/3 full. The culverts were laid approximately level. About 4 inches of sediment was observed in the downstream end of each culvert. The elevation of the culvert inverts is too high to allow for the lake to be drained.

d. Reservoir Area. The reservoir slopes are generally covered with trees and brush. Cottages are scattered along the shoreline. Annually, the sedimentation accumulates in the vicinity of the spillway opening because of the flow of water and the winds that blow south to north generally throughout the year.

e. Downstream Channel. Beyond the road the channel is narrow, brush and tree-lined, with a sand and gravel bottom that leads through a 15-acre marsh to Northwood Lake, 1.3 miles downstream. (See Appendix C - Figure 14.)

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The dam is low but has a large reservoir. The downstream area is flat and only slightly lower than the lake surface. Four houses have been built along the downstream side of the road east of the concrete portion of the dam. A great deal of sediment has filled the approach channel to the spillway creating a sandy swimming beach. The watershed above the reservoir is heavily wooded. Numerous cottages and homes have been constructed around the perimeter of the reservoir.

b. Dam. The dam consists of an earth embankment totaling about 1,180 feet in length with a concrete wall section near the outlet. (See Appendix C - Figure 2.) The crest of the dam ranges in width from 18 to 42 feet and is covered by a paved roadway. (See Appendix C - Figure 3.) The crest of the roadway was found to range in height above the water surface from 2 to 3 feet on the day of inspection. Riprap has been placed randomly on the upstream face of the embankment. Trees and brush were found on both sides of the roadway. (See Appendix C - Figure 4.) The pavement is uneven with some cracking, typical of older roads. However, no signs of lateral or vertical movement of the dam were noted.

Because the concrete portion of the dam appears only in the vicinity of the spillway, we have discussed it under the subject of Appurtenant Structures.

c. Appurtenant Structures.

(1) The visual inspection of the concrete wall and spillway section did not reveal any evidence of instability. However, the concrete has deteriorated since original placement.

The left concrete wingwall adjacent to the spillway structure has approximately 18 major cracks. The cracks are vertical, extending from the top of the wall to the currently existing ground surface on the upstream face. The cracks evidenced on the top of the wall indicate the cracks extend through the entire thickness of the wall. There is little differential movement across the cracks. The vertical cracking varies in spacing from 4 feet to 100 feet. The exposed portion of the wall has spalled in several places and spalling

SECTION 2
ENGINEERING DATA

2.1 Design

No original design data were disclosed for Pleasant Lake Dam.

2.2 Construction

No construction data were disclosed for Pleasant Lake Dam. One sketch made during an inspection report of 8/3/39 was evaluated to determine its acceptability in defining the unexposed portion of the outlet structure.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

a. Availability. Little engineering data were disclosed for Pleasant Lake Dam. A search of the files of the NHWRB revealed only a limited amount of recorded information.

b. Adequacy. Because of the limited amount of detailed data available, the final assessments and recommendations of this investigation are based on visual inspection and hydrologic and hydraulic calculations.

c. Validity. The sketch of 8/3/39, taken from the NHWRB file and made by one of its inspectors, is generally conformable to the data collected during the field inspection.

(3) Height - 10.6' (structural height)

(4) Top Width - Ranges from 18' to 42'

(5) Side Slopes - U/S & D/S - various slopes, but generally gentle.

(6) Zoning - unknown

(7) Impervious core - unknown

(8) Cutoff - unknown

(9) Grout curtain - unknown

(10) Other - 121' of concrete wall exposed including spillway.

h. Diversion and Regulating Tunnel - not applicable

i. Spillway

(1) Type - vertical-drop with stoplogs

(2) Length of weir - 2'-11" (2.92')

(3) Crest elevation - 575.2' MSL (assuming all stoplogs removed to top of downstream sediment).

(4) Gates - a 3.75' x 3' gate with a 3' x 3' gate opening below stoplogs (not operable).

(5) U/S Channel - A wooden frame made of 2" x 12" planks about 12 feet long by 3 feet wide at the upstream end and flared to about 4 feet wide at the spillway abutments, has been placed and anchored in the approach channel. About 18 inches upstream of the stoplogs a 10" x 10" timber has been placed 9 inches below the top edge of the box. This frame serves to keep the approach channel somewhat free of sand and gravel. On 31 May 1978, the frame was full of sediment, thus the reservoir bottom formed the approach channel with sandy sediment up to and on the stoplogs.

(6) D/S Channel - an 11 foot reach, 5 feet to 10 feet wide downstream of spillway leads to 2 elliptical culverts 28.5 feet long and 18" V by 30" H under roadway. Downstream of the culverts is a natural channel with overhanging trees and brush.

(3) Full flood control pool - not applicable

(4) Recreation pool - 578

(5) Spillway crest - 575.2 (assuming stoplogs removed to top of downstream sediment)

(6) Upstream portal invert diversion tunnel - none

(7) Streambed at centerline of dam - 575.2 (downstream measured at time of inspection).

(8) Maximum tailwater - unknown

d. Reservoir (miles)

(1) Length of maximum pool - 1.8

(2) Length of recreation pool - 1.8

(3) Length of flood control pool - not applicable

e. Storage (acre-feet)

(1) Recreation pool - 3,240

(2) Flood control pool - not applicable

(3) Design surcharge - unknown

(4) Top of dam (low point of embankment) - 4,215

f. Reservoir Surface (acres)

(1) Top of dam - 505

(2) Maximum pool - 505

(3) Flood control pool - not applicable

(4) Recreation pool - 468

(5) Spillway crest - 432 (with stoplogs removed)

g. Dam

(1) Type - earthen dam with concrete wall over a portion of its length.

(2) Length - 1,180'

h. Design and Construction History. Little information is available regarding the original design and construction of the dam. The earthen embankment is believed to have been built in the late 1800's. Suncook Mills is believed to have built the concrete portion including the stoplog spillway in 1921.

i. Normal Operational Procedures. No written operational procedures were disclosed. The regulation of the water level is guided by "good judgment." The operator attempts to keep the water level up during the summer recreational season by placement of stoplogs. After each July 4th weekend, the lake level is dropped 1 inch per week until Labor Day, lowering the stoplogs approximately 18-20 inches. The sand sedimentation,formed over the year by southerly winds, by then has been scoured from the approach channel. The gate has not been operable for many years because it is buried in sand.

1.3 Pertinent Data

a. Drainage Area. The drainage area consists of 3.6 square miles (2,300 acres) of predominantly steep-sloping wooded terrain.

b. Discharge at Damsite

(1) Outlet works (conduits) - none

(2) The maximum known discharge at damsite is unknown.

(3) Stoplog spillway capacity at recreational pool elevation is estimated to be 40 cfs upon removal of all stoplogs.

(4) The gated spillway capacity at pool elevation - not applicable

(5) Stoplog spillway capacity at maximum pool elevation - assuming 1 foot of freeboard, is about 85 cfs upon removal of all stoplogs.

(6) Total spillway capacity at maximum pool elevation is the same as (5) above (85 cfs).

c. Elevation (ft. above MSL) based on elevation of 578 shown on U.S.G.S. quad sheet and assumed to be pool elevation on day of inspection.

(1) Top of dam - 580

(2) Maximum pool - design surcharge - unknown

shown on U.S.G.S. Quadrangle, Suncook, New Hampshire, with coordinates approximately at N 43° 12' 06", W 71° 16' 18", Rockingham County, New Hampshire. (See Location Map page iv.)

b. Description of Dam and Appurtenances. Pleasant Lake Dam is a composite dam consisting of a 121-foot exposed concrete wall tied to earthen sections totaling approximately 1,180 feet in length. Past inspection reports (see Appendix B) reflect an overall dam length of 225 feet. The maximum structural height of the dam is about 11 feet from the base to the top of the concrete wall. This height was taken from a sketch made in 1939 by New Hampshire Water Resources Board (NHWRB). A vertical-drop stoplog spillway with maximum effective opening of 2'-11" in width by 5'-6" in height (assuming all stoplogs removed) is located in the concrete section near the left abutment (looking downstream). Normally about 3 feet of stoplogs are in place. Below the stoplogs is a 3'-9"x3' gate that is buried in bottom sediment; its exact location within the stoplog slots is unknown with respect to the bottom of the dam (see sketches in Appendix B). A paved roadway runs along the crest of the dam. The road crosses a culvert a short distance downstream of the spillway.

c. Size Classification. Intermediate (hydraulic height - 5 feet high, storage - 4,215 acre-feet) based on storage ($\geq$1,000 to $<$50,000 acre-feet) as given in OCE Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. Significant hazard. A major breach would result in the loss of less than 10 lives and some property damage.

e. Ownership. The present dam is believed to have been constructed in 1921 by Suncook Mills for use in their milling operations located in Suncook, New Hampshire. Since then the ownership has passed through other milling companies. In 1974, Thomas Hodgson & Sons, Inc. transferred its rights, title and interest to rights of flowage and property to the Town of Deerfield, New Hampshire.

f. Operator. Mr. Charles Copeland, Water Commission, Pleasant Lake, Deerfield, New Hampshire 03037. Phone (603) 453-7424.

g. Purpose of Dam. The dam was originally constructed to create greater industrial water storage for Suncook Mills. Pleasant Lake was also utilized as a water supply for the Town of Pembroke until 1949. The present purpose of the dam is only for recreational use.

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
PLEASANT LAKE DAM

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Anderson-Nichols & Company, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Anderson-Nichols & Company, Inc. under a letter of May 3, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0329 has been assigned by the Corps of Engineers for this work.

b. Purpose.

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Pleasant Lake Dam is located in the Towns of Deerfield and Northwood, New Hampshire. Pleasant Lake forms the headwaters of an unnamed tributary approximately 1.3 miles upstream of its confluence with Northwood Lake. These two lakes combine to form the headwaters of the Little Suncook River which is confluent with the Suncook River in Epsom, New Hampshire approximately 4 miles downstream of Northwood Lake. The Suncook River then flows southwesterly for a distance of about 12 miles to its confluence with the Merrimack River in Suncook, New Hampshire. The dam is

d. Need for Additional Investigation. The information available from the visual inspection is adequate to identify the potential problems which are: overtopping, seepage, and an inoperable gate. These problems require the attention of a registered professional engineer who will have to make additional engineering studies to design or specify remedial measures to rectify the problems. If left unattended, the problems could lead to instability of the structure.

7.2 Recommendations

It is recommended that the Town of Deerfield retain the services of a registered professional engineer to:

a. Evaluate further the potential for overtopping and the inadequacy of the spillway;

b. Design the remedial measures needed to eliminate the seepage around the spillway abutments;

c. Design the correctional measures for all deteriorated concrete and rotted wood. (The wooden decking could and should be removed and replaced, if the latter is deemed necessary);

d. Provide a non-destructive means to safely drain the lake.

7.3 Remedial Measures

a. Alternatives. A practical alternative to the above recommendations is that the owner should operate the reservoir at lower levels throughout the year so as to provide more storage for extreme flood events.

b. Operation and Maintenance Procedures.

(1) The seepage at the spillway box should be monitored on a weekly basis.

(2) The owner of the dam should be made aware that the spillway opening may act as a debris collector that could effectively block outflow. This could cause the water level to rise and overtop the dam.

(3) The tree and brush growth in the vicinity of the spillway and downstream of the twin culverts should be removed and kept free in the future.

(4) The owner should develop a written operational procedure to follow in the event of floodflow conditions or imminent dam failure.

(5) Round the clock surveillance should be provided by the owner during periods of unusually heavy precipitation. The town should develop a formal system for warning downstream residents in case of emergency.

APPENDIX A

CHECK LIST - VISUAL INSPECTION

PERIODIC INSPECTION

PARTY ORGANIZATION

PROJECT Pleasant Lake Dam

DATE May 31, 1978

TIME 4 P.M.

WEATHER Clear, cool

W.S. ELEV. 6.3ft. U.S. 3.7ft DN.S.

(Staff gage elevations)

PARTY:

1. _____ 6. _____

2. _____ 7. _____

3. _____ 8. _____

4. _____ 9. _____

5. _____ 10. _____

PROJECT FEATURE	INSPECTED BY	REMARKS
1. Hydraulic/Hydrologic		
2. Structural Stability		
3. Soils and Geology		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

PERIODIC INSPECTION CHECK LIST

PROJECT Pleasant Lake Dam, N.H. DATE May 31, 1978

PROJECT FEATURE Dam Embankment NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	580 (low point in roadway) (assumed)
Current Pool Elevation	Gage reading 6.3 (578 MSL) (assumed)
Maximum Impoundment to Date	Unknown
Surface Cracks	None (see Pavement Condition, below).
Pavement Condition	Uneven surface and some cracks typical of old, poorly constructed pavements.
Movement or Settlement of Crest	None (see Pavement Condition, above).
Lateral Movement	None
Vertical Alignment	Good (see Pavement Condition, above).
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good at abutment, but not at concrete outlet (see Unusual Embankment or Downstream Seepage, below).
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	None
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	Riprap on upstream face, in satisfactory condition.
Unusual Movement or Cracking at or Near Toes	None
Unusual Embankment or Downstream Seepage	Concentrated seepage, estimated at 1 cfs, discharging from soil at the abutment of the base of concrete outlet structure. Discharge water was clear. Some soil has been eroded along the sides of the outlet structure.
Piping or Boils	None
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT Pleasant Lake Dam, N.H. DATE May 31, 1978

PROJECT FEATURE Vertical-drop Spillway NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Buried in Sand - not visible
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	Weathered
Stop Logs and Slots	Not visible due to flow over top of stoplogs. Slots contain rotted timbers.

PERIODIC INSPECTION CHECK LIST

PROJECT Pleasant Lake Dam, N.H. DATE May 31, 1978

PROJECT FEATURE Vertical-drop spillway and concrete wall NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Weathered
Condition of Joints	Separated
Spalling	Some on upstream of wingwalls
Visible Reinforcing	Limited to cracks
Rusting or Staining of Concrete	Limited to areas of exposed reinforcing
Any Seepage or Efflorescence	At both downstream abutments
Joint Alignment	Little movement at cracks in walls & abutments
Unusual Seepage or Leaks in Gate Chamber	None visible
Cracks	near top of left abutment-½" wide with reinforcing bars exposed; also crack at right abutment.
Rusting or Corrosion of Steel	Stoplog keeper and bolts (timber connectors) badly rusted
b. Mechanical and Electrical	
Air Vents	None; previously installed gate mechanism has long since been removed.
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System	

PERIODIC INSPECTION CHECK LIST

PROJECT Pleasant Lake Dam, N.H. DATE May 31, 1978

PROJECT FEATURE Vertical-drop spillway NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	(Decking over spillway)
a. Super Structure	
Bearings	10" x 10" weathered timbers
Anchor Bolts	Rusted
Bridge Seat	Good
Longitudinal Members	Weathered wood beams-some deterioration
Under Side of Deck	Weathered wood
Secondary Bracing	None
Deck	Exposed wood is badly weathered
Drainage System	None
Railings	None
Expansion Joints	None
Paint	None
b. Abutment & Piers	
General Condition of Concrete	Fair, surface laitance gone, cracks at intersection with wingwalls.
Alignment of Abutment	No visible movement
Approach to Bridge	N/A
Condition of Seat & Backwall	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT Pleasant Lake Dam, N.H. DATE May 31, 1978

PROJECT FEATURE Vertical-drop spillway NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Approach channel filled with sediment to top of stoplogs.
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Sandy
b. Weir and Training Walls	
General Condition of Concrete	Weathered and cracked
Rust or Staining	Some staining below rusted bolts
Spalling	Little at concrete edges
Any Visible Reinforcing	Limited to cracks
Any Seepage or Efflorescence	None visible
Drain Holes	None
c. Discharge Channel	Channel is 5-10 ft. wide. Beneath roadway, outflow is carried by two elliptical pipes with 30-inch horizontal axis and 18-inch vertical axis.
General Condition	Poor
Loose Rock Overhanging Channel	Some loose rock and flat stones.
Trees Overhanging Channel	Brush overhanging discharge channel between outlet structure and road, also downstream of road.
Floor of Channel	Sand, gravel, and silt with a few large loose rocks.
Other Obstructions	Pipes under roadway are partially filled with sediment.

APPENDIX B

INSPECTION REPORTS/SKETCHES

PLEASANT LAKE 12/21/49

NEW HAMPSHIRE WATER CONTROL COMMISSION

REPORT ON DAM INSPECTION

TOWN [illegible] (Deerfield) DAM NO. [illegible] (61.01) STREAM

OWNER [illegible] (Suncook Mills) ADDRESS [illegible] (Suncook, NH)

In accordance with Section 20 of Chapter 133, Laws of 1937, the above dam was inspected by me on [illegible] (12/21/49) ~~accompanied by~~

NOTES ON PHYSICAL CONDITION

Abutments Very poor (Very poor)

Spillway None (None)

Gates Not operable (not operable)

Other Embankment & concrete wall (Embankment & concrete wall [illegible] Large section breached & flows over road at times.)

CHANGES SINCE LAST INSPECTION

FUTURE INSPECTIONS Yes (Yes)

This dam (is) (~~is not~~) a menace because [illegible] of pond area.

REMARKS [illegible]

[illegible] road [illegible] to mud sill. [illegible] (Dam practically in ruins)

Potential lake level problem (Potential lake level problem!)

Copy to Owner	Date

[illegible signature]

INSPECTOR

(Additional Notes Over)

JBLIC SERVICE COMMISSION OF NEW HAMPSHIRE—DAM RECORD I-[illegible]

WN Deerfield	TOWN NO 1	STATE NO. ~~113~~ 61
ER REAM Pleasant Lake		
AINAGE [illegible] sq. mi.	POND AREA 432.32	
M PE Rock Fill Stone Wall Dike	FOUNDATION NATURE OF Earth Earth	
TERIALS OF NSTRUCTION Boulders, Concrete, Earth		
RPOSE DAM POWER—CONSERVATION—DOMESTIC—RECREATION—TRANSPORTATION—PUBLIC UTILITY		
IGHTS, TOP OF M TO BED OF STREAM 10'	TOP OF DAM TO SPILLWAY CRESTS 10'	
LLWAYS LENGTHS PTHS BELOW TOP OF DAM 70"		LENGTH OF DAM [illegible]5'
ASHBOARDS PE HEIGHT ABOVE CREST 5.6'		
ERATING HEAD EST TO N. T. W.	TOP OF FLASHBOARDS TO N. T. W.	
HEELS, NUMBER NDS & H. P.		
NERATORS, NUMBER NDS & K. W.		
P. 90 P. C. TIME O P. C. EFF.	H. P. 75 P. C. TIME 100 P. C. EFF.	
FERENCES, CASES, ANS, INSPECTIONS, MARKS		

rm No. E61A

NEW HAMPSHIRE WATER CONTROL COMMISSION RECORD OF DAM NO. 61.04

wn Deerfield: County Rockingham: Local Name Pleasant Lake

nction of Dam Storage Industrial: Type Lake - Earth Boulders & Concrete

imary Basin Merrimack: Sec. Basin Suncook: Local Stream Suncook Lake

ainage Area, Total 3.56 sq. mi.: Controlled ..... sq. mi.: Net Uncontrolled ..... sq. mi.:

servoir Area, Full Pond 432 acres: At Max. Drawdown ..... acres:

servoir Capacity 141. mcf.: 3240 ac. ft.: ..... in. net D. A.: 17.06 in. Total D. A.:

erall Length of Dam 225 ft.: Max. Depth Water at Dam 10 ft.:

t Spillway Length 215 ft.: Minimum Freeboard 2.65 ft.:

illway Capacity 31 cfs.: 8.7 cfs. per sq. mi.:

ghest Flood Flow of Record 92 cfs.: 25.8 cfs. per sq. mi.: Date .....:

t ted Maximum Probable Flood ..... cfs.:

MARKS:

rd Prepared by CFD.: Checked by .....: Approved for File .....: Date 9/4/39

WNER Suncook Mills, Suncook, N. H. — CONTRACTOR — NO

	RECEIVED	INVESTIGATED BY	DATE
PLICATION			

AM IMPROPERLY CONSTRUCTED IT — BE A MENACE TO THE PUBLIC SAFETY

AM SUBJECT TO PROVISIONS OF P. L. CHAP. 218, SECTS 15-28?

	RECEIVED	CHECKED BY	DATE
NS & CIFICATIONS			
	APPROVED BY COMMISSION	COMMISSION CONSTRUCTION INSPECTOR	

L CONSTRUCTION APPROVAL — CHARGES — PAID

AM SUBJECT TO PERIODIC INSPECTION?

DAM INSPECTION RECORD

TE	INSPECTOR	REPORT	CHARGES	PAID	DATE	INSPECTOR	REPORT	CHARGES	PAID
934				1934					
-30			$8.00	11-19					
0/39	CDC	Fair condition							

(

WNER Suncook Mills : ADDRESS Suncook N. H. : CASE NO.

ontractor : Address

Construction Record

Date	Office-Routine	Date	Inspector	Memo	Date	Inspector	Memo
		Inspection During Construction					
pplication Received							
oard Approval							
uthorization Sent							
inal Plans Rec'd							
inal Approval-Board							
inal Approval-Sent							
ase Closed							

Dam a Menace Yes :

Why Road below - also farm land

Dam Inspection Record

e	Inspector	Comments	Memo Prepared	Memo Sent To Owner
7/20/39	C.D.C.	Guide [illegible] cracked off. Should be replaced		

NEW HAMPSHIRE WATER RESOURCES BOARD CONCORD, N. H.

PROJECT

SUBJECT Pleasant Lake Deerfield Sunapee Mills

FILE 61.01

ACC

COMPUTER CHECKER CONT FROM ACC CONT ON ACC SUMMARY ON ACC DATE 8/3/37

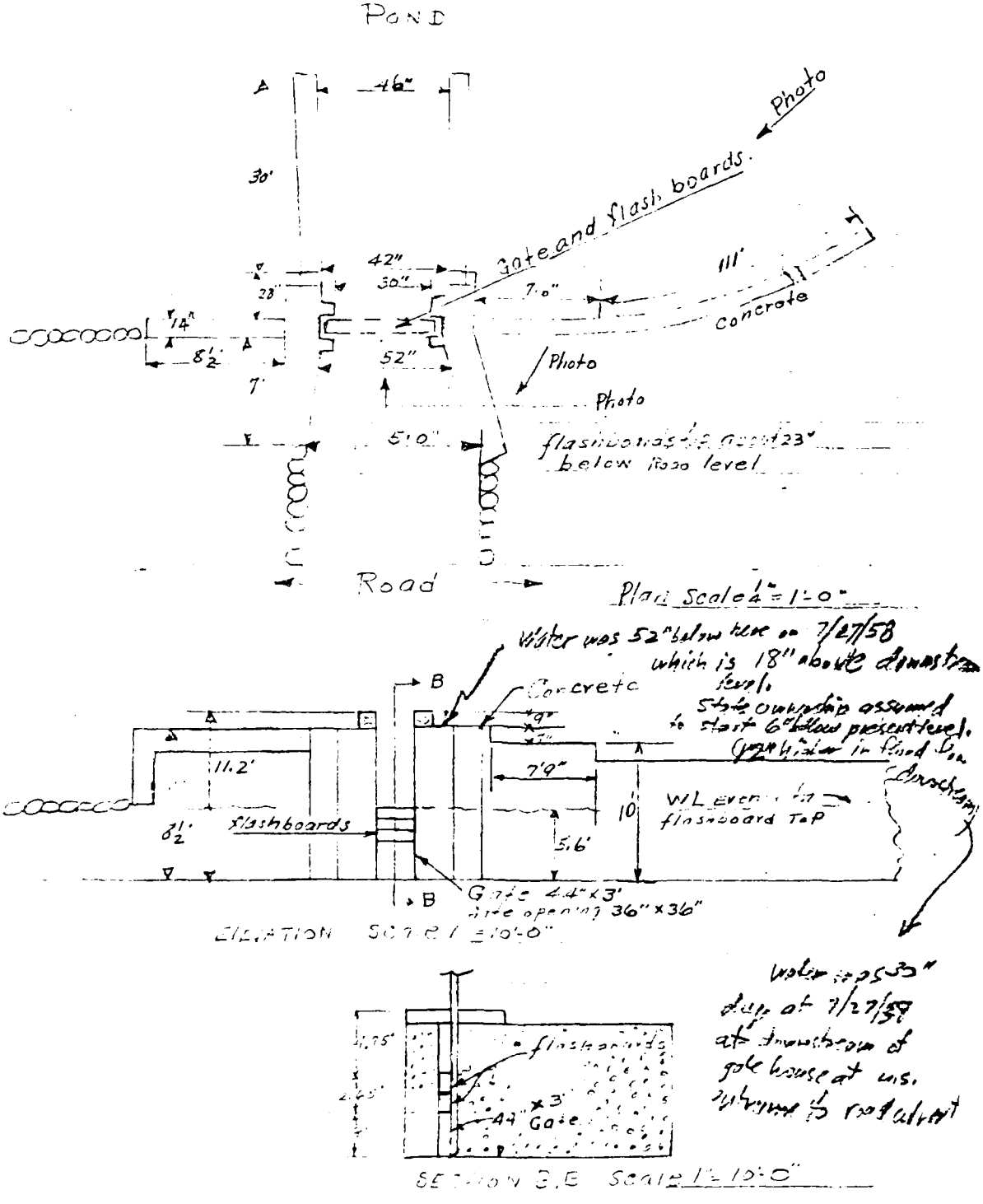
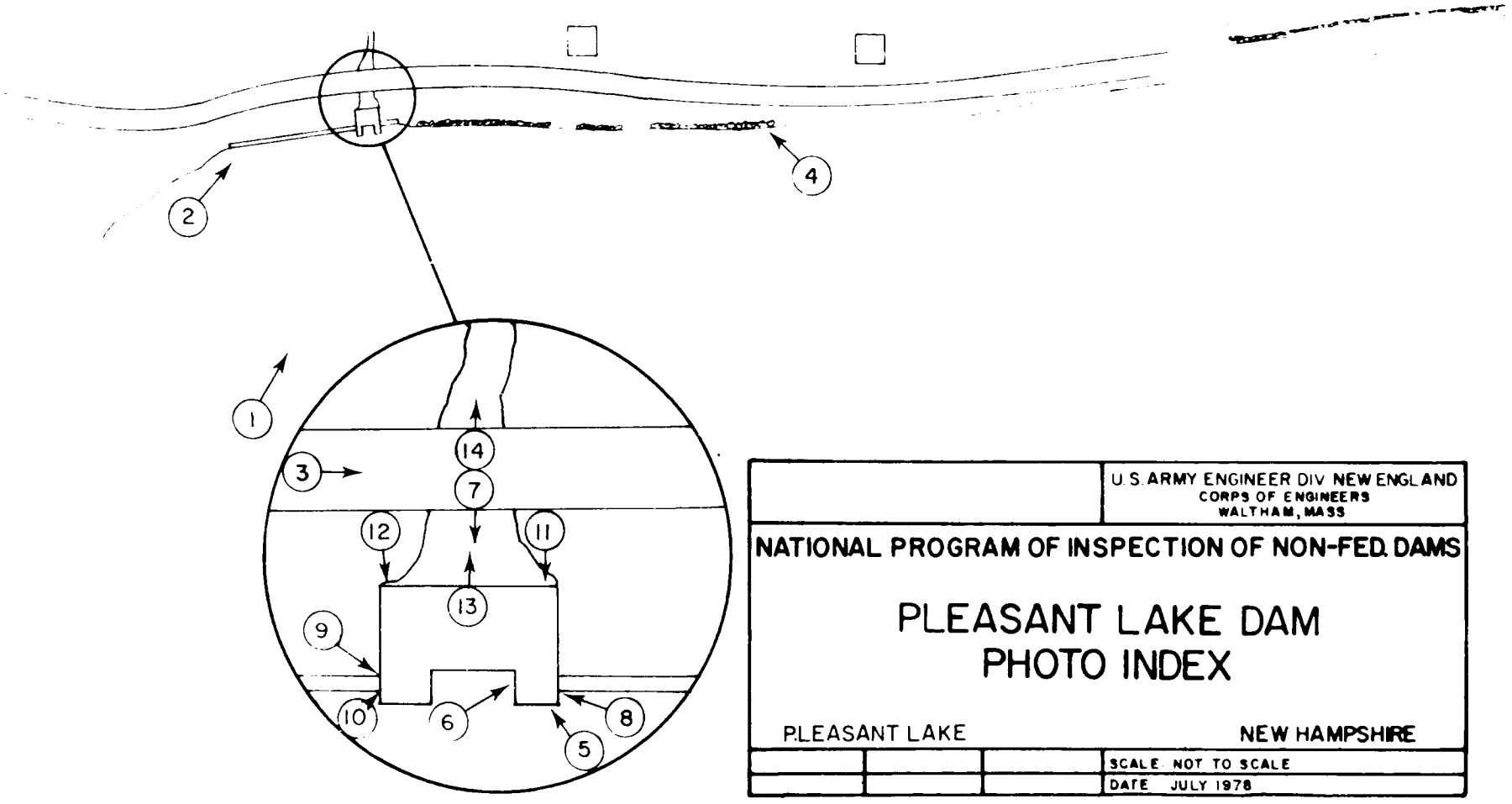


Figure 2 - View taken from west abutment looking east at upstream face of dam. Outlet structure can be seen at the right.

Figure 3 - Looking east along embankment from approximately 50 feet west of the outlet structure.



U.S. ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PLEASANT LAKE DAM
PHOTO INDEX

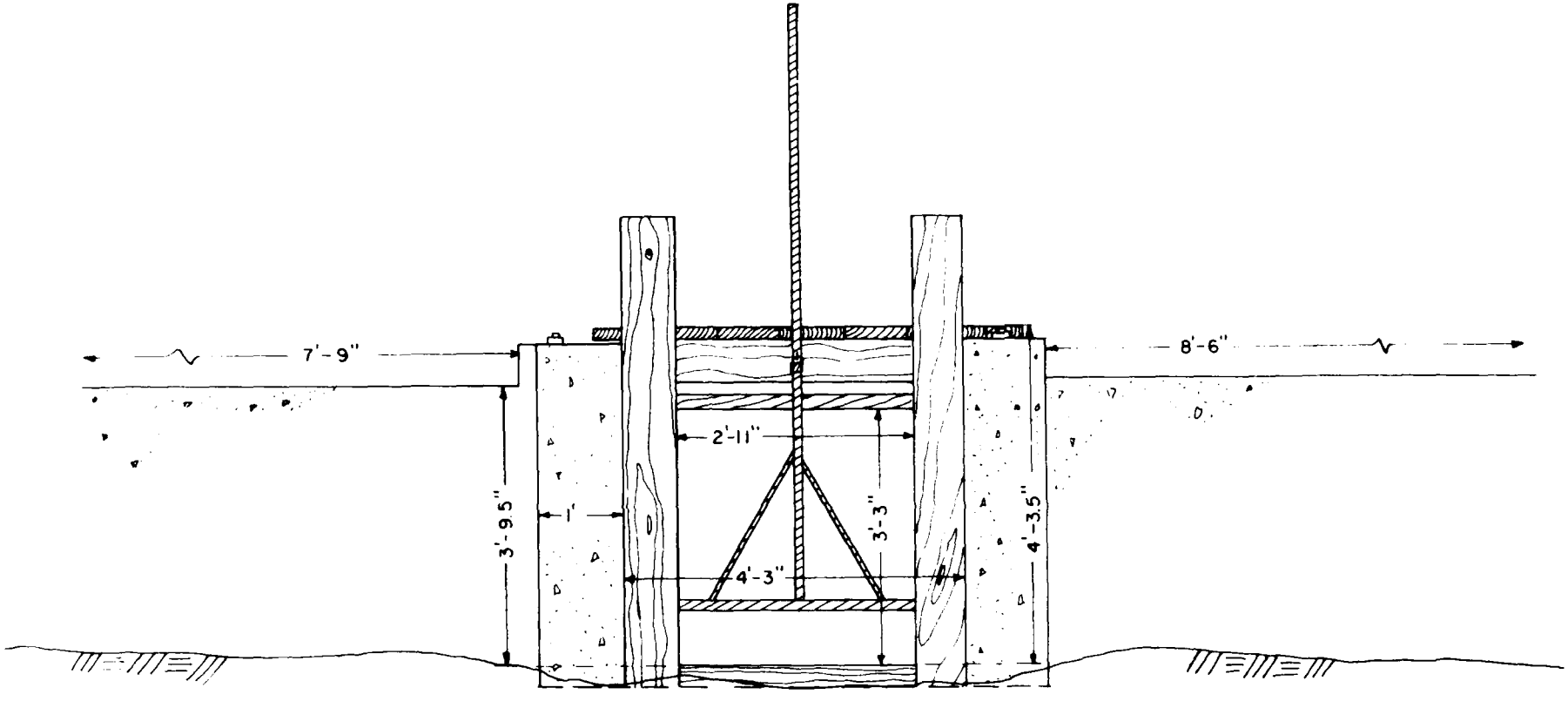
PLEASANT LAKE — NEW HAMPSHIRE

SCALE NOT TO SCALE

DATE JULY 1978

APPENDIX C

PHOTOGRAPHS



SPILLWAY DETAIL
UPSTREAM FACE

Note:
For detail below water surface see Profile Plate.
Data based on field measurements.

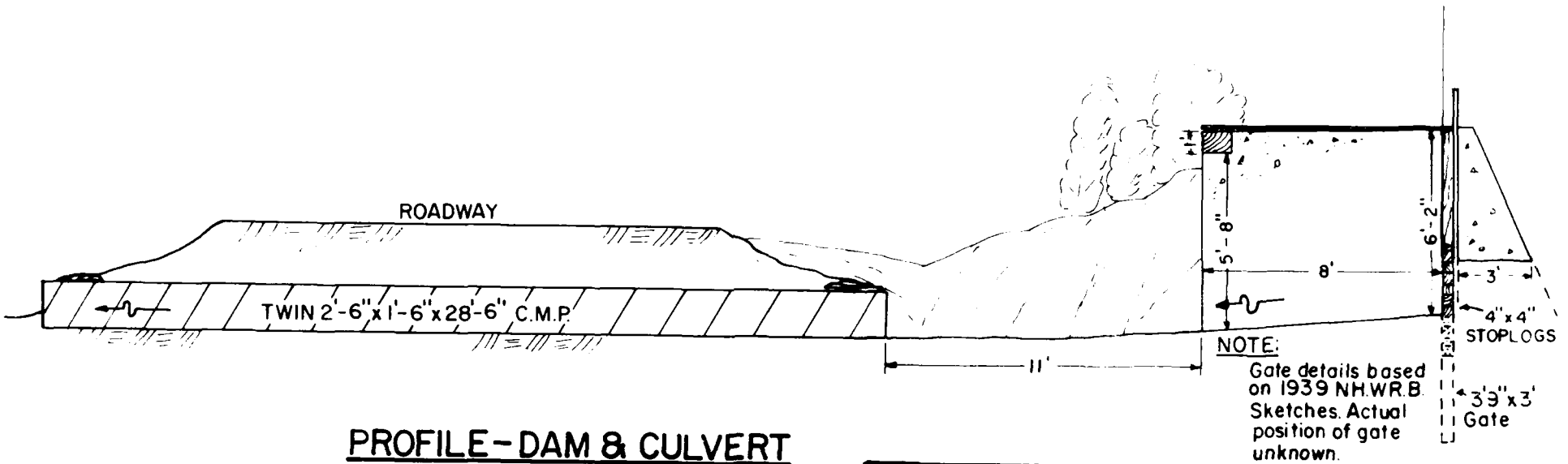
U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PLEASANT LAKE DAM

PLEASANT LAKE — NEW HAMPSHIRE

SCALE: NOT TO SCALE
DATE: JULY 1978



NOTE:
Gate details based on 1939 N.H.W.R.B. Sketches. Actual position of gate unknown.

PROFILE - DAM & CULVERT

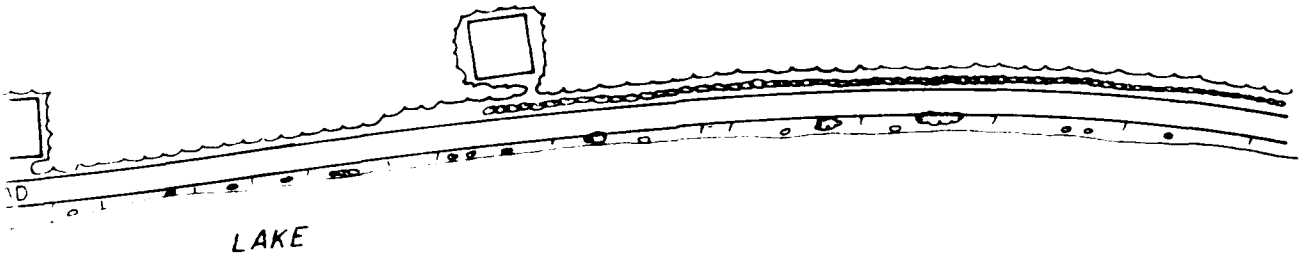
U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

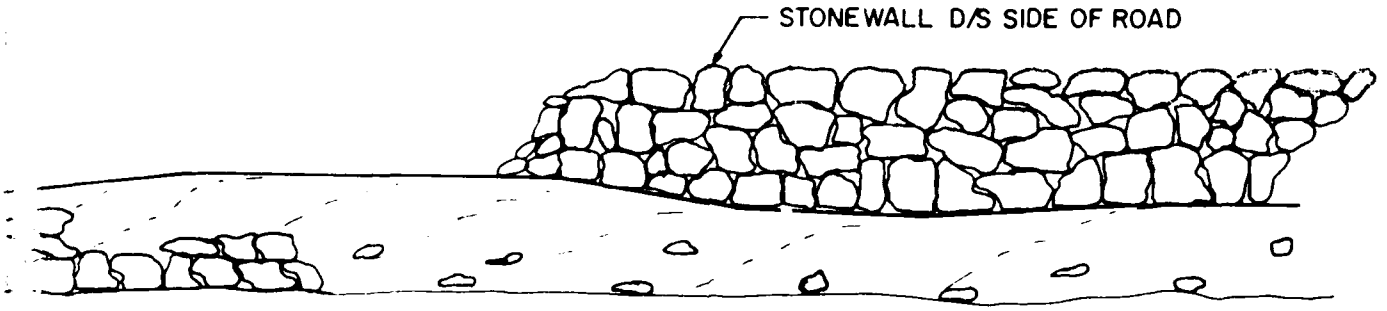
PLEASANT LAKE DAM

PLEASANT LAKE — NEW HAMPSHIRE

SCALE: NOT TO SCALE
DATE: JULY 1978

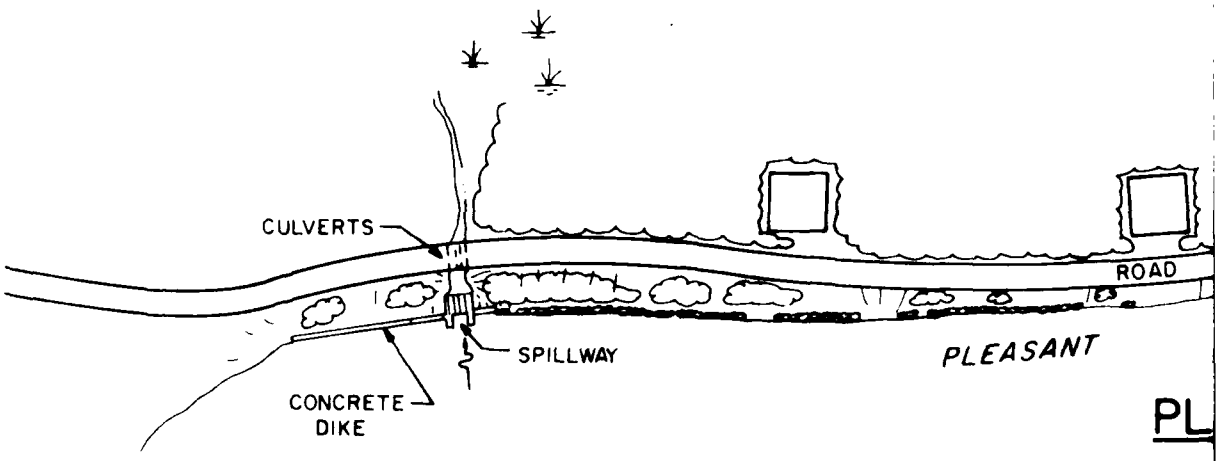


PLAN

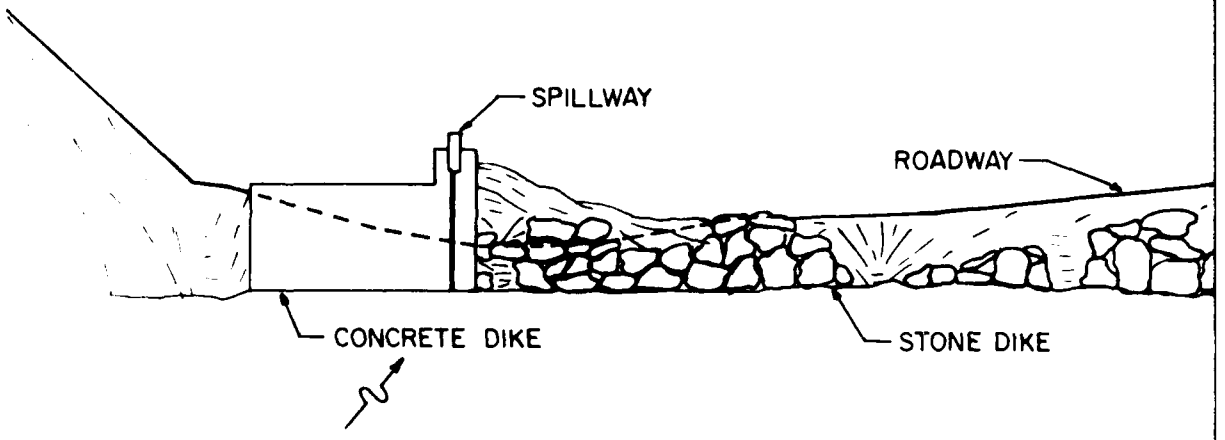


EVATION

	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
PLEASANT LAKE DAM	
PLEASANT LAKE	NEW HAMPSHIRE
SCALE: NOT TO SCALE	
DATE: JULY 1978	



PL



ELEV

NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

BASIN [illegible] NO. 1 — 190 — I-3579 3.6 [illegible]

RIVER Pleasant Pond MILES FROM MOUTH ____ D.A.SQ.MI. 3.9

TOWN [illegible] OWNER [illegible] Suncook, NH

LOCAL NAME OF DAM ____ (State of N.H. AE)

BUILT 1921 AE DESCRIPTION [illegible] – Boulders, Concrete, Earth on Earth

POND AREA-ACRES [illegible] DRAWDOWN FT. 5 POND CAPACITY-ACRE FT. 5000

HEIGHT-TOP TO BED OF STREAM-FT. 10 MAX. ____ MIN. ____

OVERALL LENGTH OF DAM-FT. 2[illegible] MAX.FLOOD HEIGHT ABOVE CREST-FT. ____

PERMANENT CREST ELEV.U.S.G.S. ____ LOCAL GAGE ____

TAILWATER ELEV.U.S.G.S. ____ LOCAL GAGE ____

SPILLWAY LENGTHS-FT. 25 FREEBOARD-FT. 10

FLASHBOARDS-TYPE, HEIGHT ABOVE CREST 5.6

WASTE GATES-NO.	WIDTH	MAX. OPENING	DEPTH SILL BELOW CREST

REMARKS Condition Poor

[illegible] Suncook R., Little Suncook R., Suncook R.

Coordinates from A.E.
N 43° 10' + 4300 yds
W 71° 15' + 1850 "

POWER DEVELOPMENT

UNITS	NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE

USE Conservation Water Supply

REMARKS Water supply for Town of Pembroke. Epsom also uses water for [illegible] fire protection hydrants along Turnpike.

DATE 7/30/34

OWNER Suncook Mills | CONTRACTOR | NO.

APPLICATION

RECEIVED | INVESTIGATED BY | DATE

IF DAM IMPROPERLY CONSTRUCTED IT WOULD BE A MENACE TO THE PUBLIC SAFETY

IS DAM SUBJECT TO PROVISIONS OF P. L. CHAP. 218, SECTS 15-26?

PLANS & SPECIFICATIONS

RECEIVED | CHECKED BY | DATE

APPROVED BY COMMISSION | COMMISSION CONSTRUCTION INSPECTOR

FINAL CONSTRUCTION APPROVAL | CHARGES | PAID

IS DAM SUBJECT TO PERIODIC INSPECTION?

DAM INSPECTION RECORD

DATE	INSPECTOR	REPORT	CHARGES	PAID	DATE	INSPECTOR	REPORT	CHARGES	PAID

PUBLIC SERVICE COMMISSION OF NEW HAMPSHIRE—DAM RECORD 1-3599

TOWN DEERFIELD	TOWN NO. 1	STATE NO. 61.01
RIVER STREAM PLEASANT LAKE		
DRAINAGE AREA 3.9 sq. mi.	POND AREA 42 ac.	
DAM TYPE WALL DIKE	FOUNDATION NATURE OF EARTH	
MATERIALS OF CONSTRUCTION BOULDERS, CONCRETE, EARTH		
PURPOSE OF DAM POWER—CONSERVATION—DOMESTIC—RECREATION—TRANSPORTATION—PUBLIC UTILITY		
HEIGHTS, TOP OF DAM TO BED OF STREAM 10'	TOP OF DAM TO SPILLWAY CREST 10'	
SPILLWAYS, LENGTHS 30" DEPTHS BELOW TOP OF DAM		LENGTH OF DAM 225'
FLASHBOARDS TYPE, HEIGHT ABOVE CREST 5.6'		
OPERATING HEAD CREST TO N. T. W.	TOP OF FLASHBOARDS TO N. T. W.	
WHEELS, NUMBER KINDS & H. P.		
GENERATORS, NUMBER KINDS & K. W.		
H. P. 90 P. C. TIME 100 P. C. EFF.	H. P. 75 P. C. TIME 100 P. C. EFF.	
REFERENCES, CASES, PLANS, INSPECTIONS. REMARKS		

8161

B-9

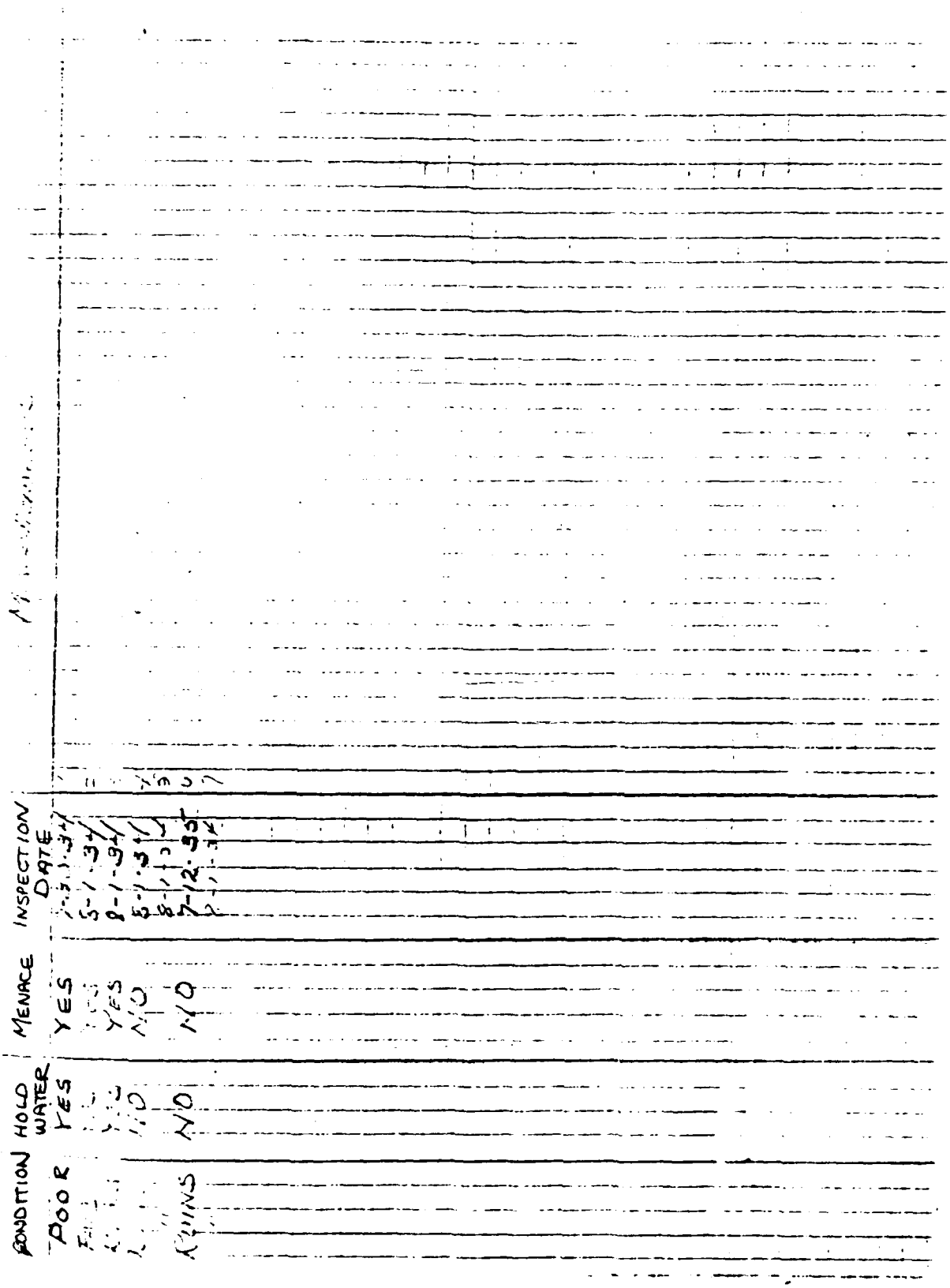
July 30, 1934

Co. ..... No .....

CALCULATION SHEET

Refers to ..... Date .....

Made By .....



Co. ....

Refers to .... [illegible]

CALCULATION SHEET

Date ....

Made By ....

No. ....

[illegible]

[illegible] No.	[illegible] No.	[illegible] No.	LOCATION	OWNER	DAM TYPE	L	W	H
1	1	3599	PLEASANT LAKE OUTLET	SUNCOOK MILL	[illegible]	225		10'
2	2	[illegible]	FREESES POND	Jennie [illegible]	" " "	163	14'	7'-9"
3	3	[illegible]	[illegible]	Walter [illegible]	" " "	[illegible]		[illegible]
4	4	[illegible]	" "	" "	" " "	[illegible]		[illegible]
5	5	4091						
6	6	[illegible]	[illegible] RIVER	UNKNOWN	[illegible]	225		15'
7	7	4093						

7265

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON RESERVOIRS & PONDS IN NEW HAMPSHIRE

LOCATION AT DAM NO. 31.01

Town Natal (Deerfield) : County Rockingham (Rockingham)

Stream Pleasant Lake (Pleasant Lake)

Basin—Primary Merrimack R. : Secondary Suncook R.

Local Name

DRAINAGE AREA

Controlled ..... Sq. Mi.: Uncontrolled ..... Sq. Mi.: Total 3.56 3.50 Sq. Mi.

ELEVATION vs. WATER SURFACE AREA vs. VOLUME

	Point	Head Feet	Surface Area Acres	Volume Acre Ft.
(1)	Max. Flood Height			
(2)	Top of Flashboards			
(3)	Permanent Crest			
(4)	Normal Drawdown	100	432 (432)	33240
(5)	Max. Drawdown			
(6)	Original Pond	U.S.G.S. 578 (USGS - 578)		

Base Used ..... : *Coef. to change to U.S.G.S. Base*

RESERVOIR CAPACITY

	Total Volume	Useable Volume
Drawdown	ft.	ft.
Volume	ac. ft.	ac. ft.
Acre ft. per sq. mi.		
Inches per sq. mi.		

USE OF WATER Storage Industrial

OWNER Suncook Mills Suncook N.H.

REMARKS

Tabulation By A.A.N & R.L.T Date November 15, 1953

7206

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON DAMS IN NEW HAMPSHIRE

LOCATION STATE NO. 61.01

Town (Deerfield) : County (Rockingham)

Stream (Pleasant Lake)

Basin-Primary Merrimack R. & R. : Secondary (Suncook R.)

Local Name

Coordinates—Lat. [illegible] : Long. 71° 15' [illegible]

GENERAL DATA

Drainage area: Controlled ..... Sq. Mi.: Uncontrolled ..... Sq. Mi.: Total 5.56 Sq. Mi.

Overall length of dam 225 ft.: Date of Construction 1921

Height: Stream bed to highest elev. 10' ft.: Max. Structure 0 ft.

Cost—Dam : Reservoir

DESCRIPTION W Dike Boulders- Concrete- Earth Foundation

Waste Gates (W Dike Boulders - Concrete - Earth Foundation)

Type

Number : Size ft. high x ft. wide

Elevation Invert : Total Area sq. ft.

Hoist

Waste Gates Conduit

Number : Materials

Size ft.: Length ft.: Area sq. ft.

Embankment

Type

Height—Max. ft.: Min. ft.

Top—Width : Elev. ft.

Slopes—Upstream on : Downstream on

Length—Right of Spillway : Left of Spillway

Spillway

Materials of Construction Concrete (Concrete)

Length—Total ft.: Net 30" ft.

Height of permanent section—max. 0' ft.: Min. ft.

Flashboards—Type : Height 5.6' ft.

Elevation—Permanent Crest : Top of Flashboard

Flood Capacity 922 cfs.: 25.8 25.8 cfs/sq. mi.

Abutments

Materials: concrete

Freeboard: Max. ft.: Min. ft.

Headworks to Power Devel.—(See "Data on Power Development")

OWNER Suncook, N. H.

REMARKS Storage - Industrial

Tabulation By [illegible] Date [illegible]

Figure 4 - View of upstream face looking west from approximately 450 feet east of outlet structure.

Figure 5 - Looking west at spillway entrance.

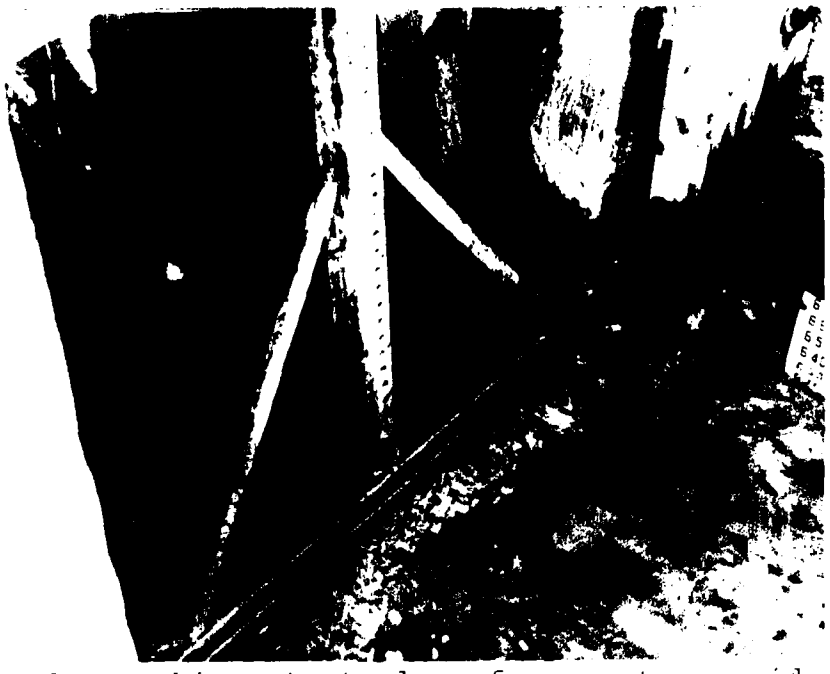


Figure 6 - Looking at stoplogs from upstream side on 5/31/78 at 5:30 P.M. Water level reads 6.30.

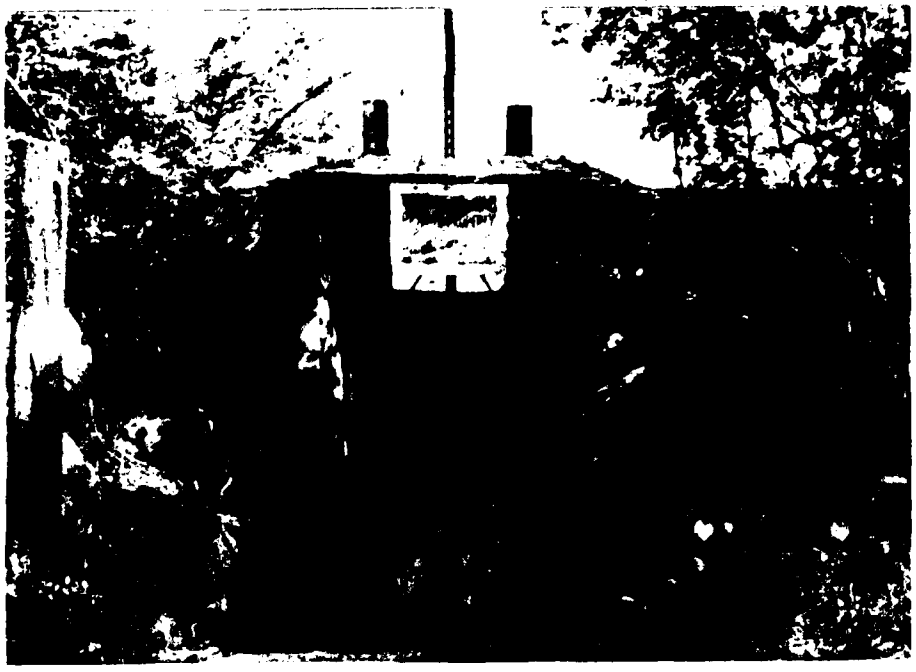


Figure 7 - View looking upstream at outlet structure from center of road.

Figure 8 - Crack near top of east outlet wall.

Figure 9 - Crack at intersection of west concrete wingwall and spillway abutment looking from the downstream side.

Figure 10 - Same crack as previous figure but looking from upstream side.

Figure 11 - View of seepage near bottom of downstream end of east outlet wall.

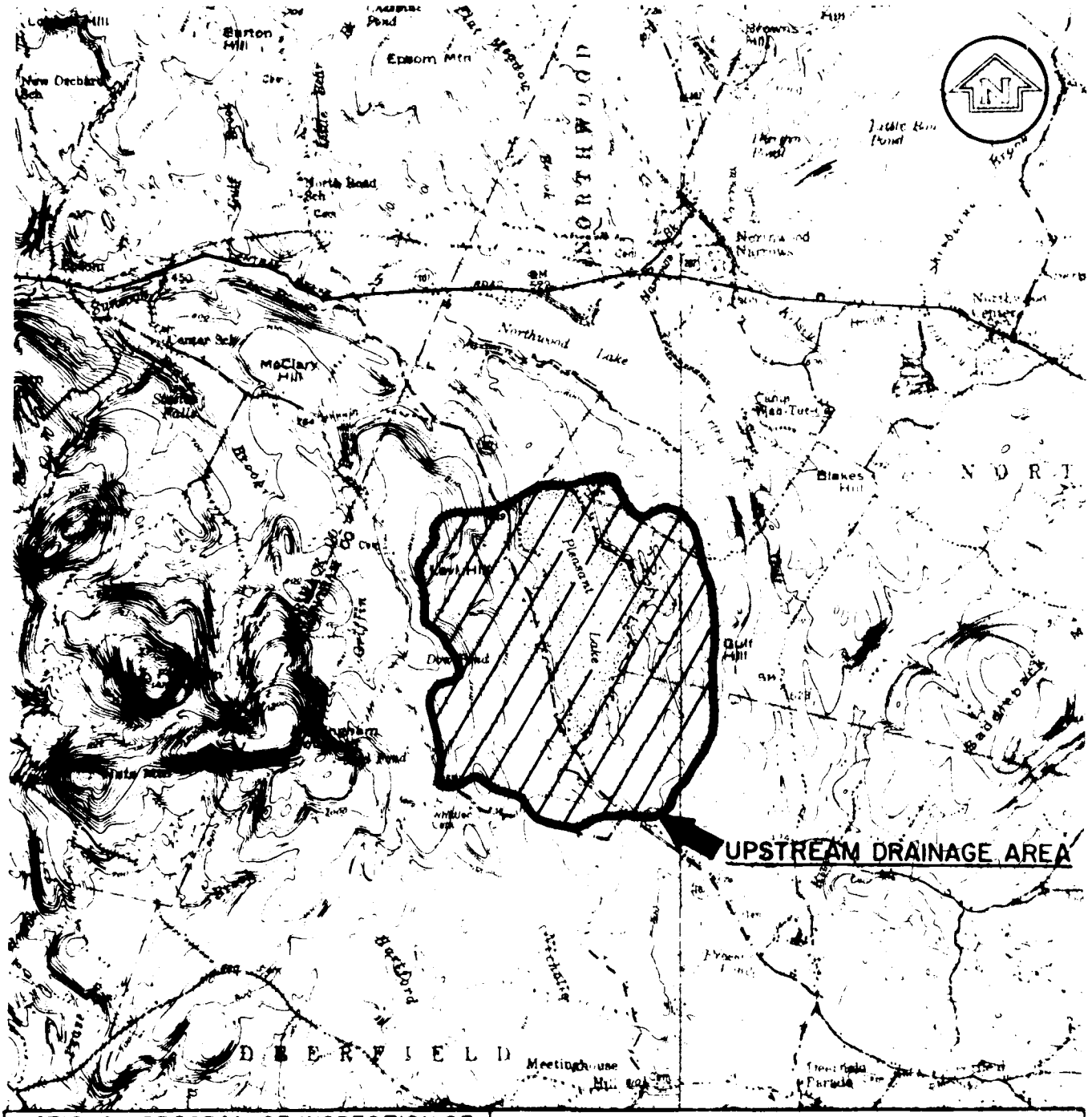
Figure 12 - View of seepage near bottom of downstream end of west outlet wall.

Figure 13 - View of upstream face of twin culverts under road located 11 feet downstream of outlet structure.

Figure 14 - View of downstream channel from north side of road.

APPENDIX D

HYDROLOGY/HYDRAULICS



NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PLEASANT LAKE DAM

DEERFIELD, NEW HAMPSHIRE

REGIONAL VICINITY MAP

JULY 1978

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

SCALE IN MILES

0 1 2

MAP BASED ON U.S.G.S. 15 MINUTE QUADRANGLE SHEET **SUNCOOK, N.H. 1957 and Mt. PAWTUCKAWAY, N.H. 1957**

Subject H/H

Sheet No. 1 of 12
Date 6/15/78
Computed
Checked

JOB NO. 3141-09 Pleasant Lake Dam

DA = 3.58 mi²
Size Classification = INTERMEDIATE
Hazard Classification = SIGNIFICANT
Inspection Flood = ½ PMF to PMF

Calculate PMF using "Preliminary Guidance For Estimating Maximum Probable Discharges for Phase I Dam Safety Investigations, Md., 1978."

Use Flat & Coastal

@ 3.58 mi² P.M.F. in cfs/mi² = 850

P.M.F. for Pleasant Lake is:

850 cfs/mi² × 3.58 mi² = 3043 cfs

PEAK INFLOW = 3045 cfs

Assume:

C value of 2.8 (used by W.R.B.)
opening height 3'3" or 3.25'
length 2'11" or 2.92'
no stoplogs except those silted in
Solve for PMF

Assume opening conditions as they exist presently ie. stoplogs silted in.

578 msl - spillway elev. / normal pool elev.
Spillway used as found on day of inspection.

Subject [illegible]

Sheet No [illegible] of [illegible]
Date
Computed
Checked

JOB NO. 3141-09

Step #2a

Determine surcharge height to pass peak inflow

TRIAL # 1

Assume elevation equal to dike 3.3' above spillway

$Q_{OUTLET} = CLH^{3/2}$

$= 2.8(2.92)(3.3)^{3/2}$

$= 49.01 = 49$ cfs

$Q_{WEIR} = CLH^{3/2}$

$= 2.8(110)(0.42)^{3/2} + 2.8(\frac{1}{2}80)(1.3)^{3/2} +$
$2.8(100)(1.2)^{3/2} + 2.8(\frac{1}{2}200)(1.1)^{3/2} +$
$2.8(170)(0.2)^{3/2}$

$= 84 + 166 + 368 + 323 + 43.$

$= 984$ cfs

$Q_{TOT} = Q_{OUT} + Q_{WEIR}$

$= 49 + 984 = \underline{1033}$ cfs

TRIAL #2

Assume elevation equal to dike 3.8' above spillway

$Q_{OUTLET} = CLH^{3/2}$

$= 2.8(2.92)(3.8)^{3/2}$

$= 60.56 = 61$ cfs

$Q_{WEIR} = CLH^{3/2}$

$= 2.8(\frac{1}{2}18)(0.92)^{3/2} + 2.8(138)(0.92)^{3/2} +$
$2.8(38)(0.5)^{3/2} + 2.8(\frac{1}{2}24)(0.5)^{3/2} +$
$2.8(\frac{1}{2}110)(1.8)^{3/2} + 2.8(100)(1.8)^{3/2} + 2.8(\frac{1}{2}34)(1.1)^{3/2} +$
$2.8(\frac{1}{2}112)(0.7)^{3/2} + 2.8(56)(0.7)^{3/2} + 2.8(\frac{1}{2}9)(0.7)^{3/2}$

$= 22 + 341 + 38 + 12 + 372 + 676 + 974 + 92 + 92 + 7$

$= 2626$ cfs

$Q_{TOT} = Q_{OUT} + Q_{WEIR}$

$= 61 + 2626 = \underline{2687}$ cfs

Subject H/H

Sheet No. 3 of 12
Date
Computed
Checked

JOB NO. 3141-09

JARES IN. SCALE 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

TRIAL #3

Assume elevation @ top of dam 4.3' above spillway

$Q_{OUTLET} = CLH^{3/2}$

$= 2.8(2.92)(4.3)^{3/2}$

$= 72.9 = 73$ cfs

$Q_{WEIR} = CLH^{3/2}$

$= 2.8(\frac{1}{2}32)(1.42)^{3/2} + 2.8(140)(1.42)^{3/2} + 2.8(85)(0.5)^{3/2} +$
$2.8(7.75)(0.5)^{3/2} + 2.8(10)(1.0)^{3/2} + 2.8(\frac{1}{2}52)(1.0)^{3/2} +$
$2.8(\frac{1}{2}138)(2.2)^{3/2} + 2.8(100)(2.2)^{3/2} + 2.8(\frac{1}{2}380)(2.1)^{3/2} +$
$2.8(\frac{1}{2}170)(1.1)^{3/2} + 2.8(\frac{1}{2}10)(1.1)^{3/2}$

$= 76 + 663 + 8 + 8 + 28 + 73 + 630 + 914 + 1619 +$
$275 + 16$
$= 4310$ cfs

$Q_{TOT} = Q_{OUT} + Q_{WEIR}$

$= 73 + 4310 = \underline{\underline{4383}}$ cfs

2687 cfs @ 3.8' above spillway
4383 cfs @ 4.3' above spillway

$\therefore \frac{4383 - 2687}{4.3 - 3.8} = \frac{4383 - 3045}{V}$

$\frac{1696}{.50} = \frac{1338}{V}$

$V = .39$

$4.3 - .39 = 3.91$

TRIAL #4

Assume elevation @ 3.9' above spillway

$Q_{OUTLET} = CLH^{3/2}$

$= 2.8(2.92)(3.9)^{3/2}$

$= 63$ cfs

Subject H/H

Sheet No. 1 of 12
Date
Computed
Checked

JOB NO. 3141-09

ELEV. @ 3.9' ABOVE SPILLWAY

$Q_{WEIR} = CLH^{3/2}$

$= 2.8(\frac{1}{2}21)(1.02)^{3/2} + 2.8(138)(1.02)^{3/2} +$
$2.8(7.75)(0.1)^{3/2} + 2.8(8.5)(0.1)^{3/2} + 2.8(10)(0.6)^{3/2} +$
$2.8(\frac{1}{2}50)(0.6)^{3/2} + 2.8(\frac{1}{2}138)(1.9)^{3/2} + 2.8(100)(1.9)^{3/2} +$
$2.8(\frac{1}{2}335)(1.8)^{3/2} + 2.8(\frac{1}{2}136)(0.8)^{3/2} +$
$2.8(34)(0.8)^{3/2} + 2.8(\frac{1}{2}9)(0.8)^{3/2}$

$= 30 + 398 + 1 + 1 + 13 + 33 + 506 + 733 + 1133 +$
$136 + 68 + 9$
$= 3061$

$Q_{TOT} = Q_{OUT} + Q_{WEIR}$
$= 63 + 3061 = \underline{3124}$ cfs

Storage
From Dam Inventory
Normal - 3240
Maximum - 4750
432 ACRES
468 - calculated 6/12/78 surface area

Subject: Pleasant Lake — H | H

Sheet No. 5 of 12
Date [illegible]
Computed [illegible]
Checked

JOB NO. 3141-09

'Frustrum of Pyramid'

$$V = \tfrac{1}{3} h \left(b_1 + b_2 + \sqrt{b_1 b_2} \right)$$

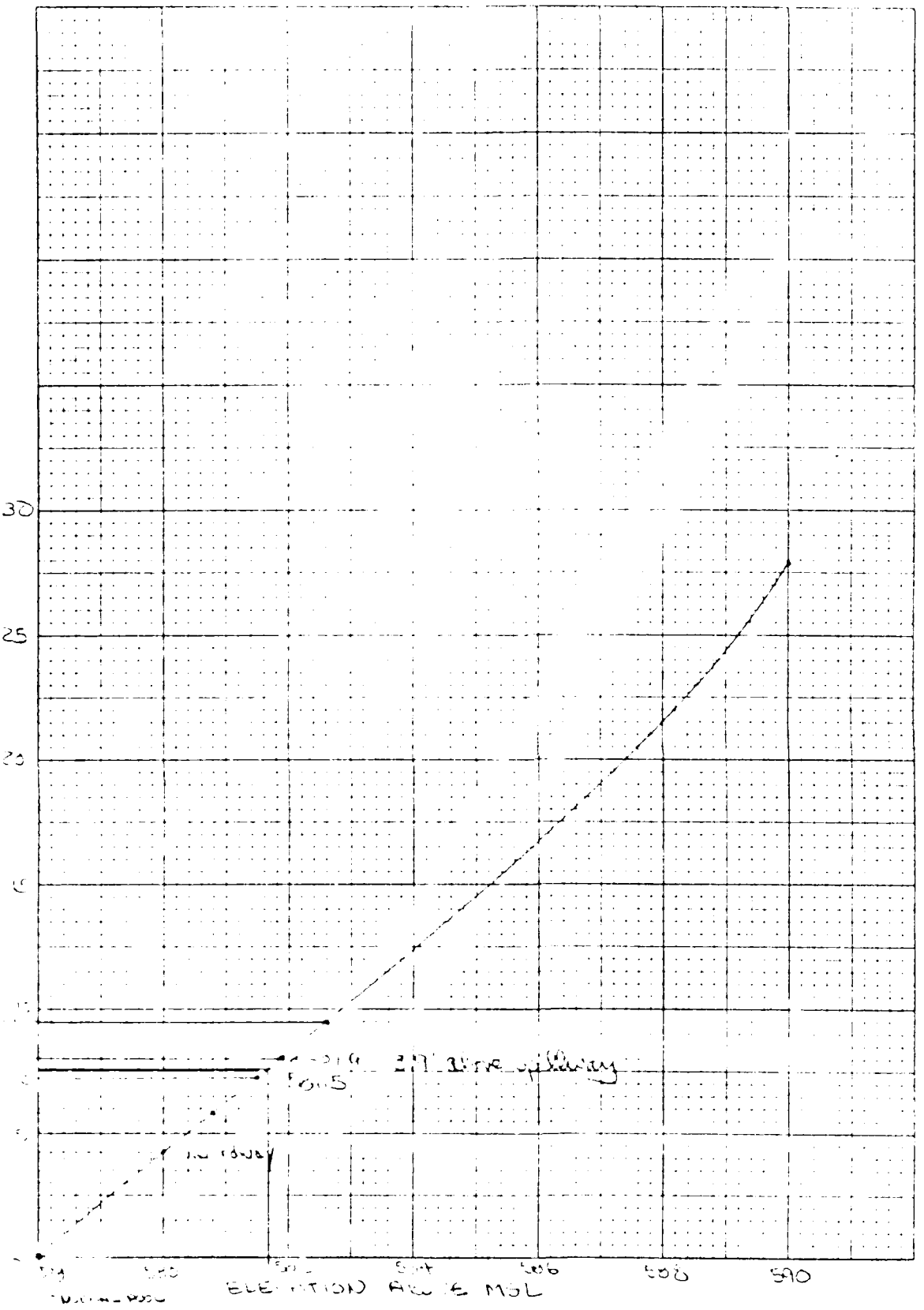
- h = elev. above normal pool
- b_1 = normal pool surface area in ft^2
- b_2 = enlarged surface area in ft^2

Normal pool elev. from quad = 578
Surface area = 468 acres = 20386080 ft^2

@ Elev. 580
Surface area = 505 acres = 21997800 ft^2

$V = \tfrac{1}{3}\, 2 \left(20386080 + 21997800 + \sqrt{20386080 \times 21997800}\right)$
$V = \tfrac{1}{3}\, 2 \left(42383880 + 21176612\right)$
$V = \tfrac{1}{3}\, 2 \left(63560492\right)$
$V = 42373661\ ft^3 \quad 4.24 \times 10^7$

@ Elev. 590 Surface area = 560 acres = 24393600 ft^2
$V = \tfrac{1}{3}\, 12 \left(20386080 + 24393600 + \sqrt{20386080 \times 24393600}\right)$
$= \tfrac{1}{3}\, 12 \left(44779680 + 22299997\right)$
$= 268318709.3 \quad 26.8 \times 10^7$


30
25
20
15
10
5
ELEVATION ABV MSL

Subject H/H

Sheet No. 7 of 12
Date 6/29/18
Computed L Williams
Checked

JOB NO. 3141-09

JARES IN. SCALE 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

2b

@ Surcharge Height to pass PMF 3045 cfs

$8.0 \times 10^7 \text{ ft}^3 = \text{Volume}$

e Spillway $0 \text{ ft}^3 = \text{Volume}$

$$8 \times 10^7 \text{ ft}^3 \times \frac{1}{3.58 \text{ mi}^2} \times \frac{1 \text{ mi}^2}{(5280)^2 \text{ ft}^2} = .80 \text{ ft.}$$

$$.80 \text{ ft} \times 12 \text{ in/ft} = 9.6 \text{ inches runoff}$$

2c

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{\text{STOR1}}{19''}\right)$$

$$Q_{p2} = 3045 \text{ cfs} \times \left(1 - \frac{9.6''}{19''}\right)$$

$$Q_{p2} = 1506 \text{ cfs} \Rightarrow 1510 \text{ cfs}$$

Step 3a

Determine surcharge height & "STOR2" to Pass "Qp2"

Trial #1

Assume elevation 3.4' above spillway

$$Q_{OUTLET} = CLH^{3/2}$$
$$= 2.8(2.92)(3.4)^{3/2}$$
$$= 51 \text{ cfs}$$

$$Q_{WEIR} = CLH^{3/2}$$
$$= 2.8(130)(0.52)^{3/2} + 2.8(68)(0.1)^{3/2} + 2.8(\tfrac{1}{2}\,30)(1.4)^{3/2} +$$
$$2.8(100)(1.3)^{3/2} + 2.8(\tfrac{1}{2}200)(1.2)^{3/2} + 2.8(170)(0.3)^{3/2}$$

$$= 136 + 6 + 186 + 415 + 368 + 78$$

$$= 1189 \text{ cfs}$$

ARES N. SCALE

$Q_{TOT} = Q_{OUT} + Q_{WEIR}$
$= 51 + 1189$
$= 1240$ cfs

Trial #3
Assume elevation 3.5' above spillway

$Q_{OUTLET} = CLH^{3/2}$
$= 2.8(2.92)(3.5)^{3/2}$
$= 54$ cfs

$Q_{weir} = CLH^{3/2}$
$= 2.8(\frac{1}{2}10)(0.62)^{3/2} + 2.8(130)(0.62)^{3/2} + 2.8(50)(0.2)^{3/2} +$
$2.8(\frac{1}{2}90)(1.4)^{3/2} + 2.8(100)(1.5)^{3/2} + 2.8(\frac{1}{2}250)(13)^{3/2} +$
$2.8(130)(0.4)^{3/2}$

$= 7 + 178 + 13 + 209 + 514 + 519 + 92$

$= 1532$ cfs

$Q_{TOT} = Q_{OUT} + Q_{WEIR}$
$= 1532 + 54 = 1586$ cfs @ 3.5' above spillway

From St-Elev Curve:

@ 578 + 3.5 = 581.5

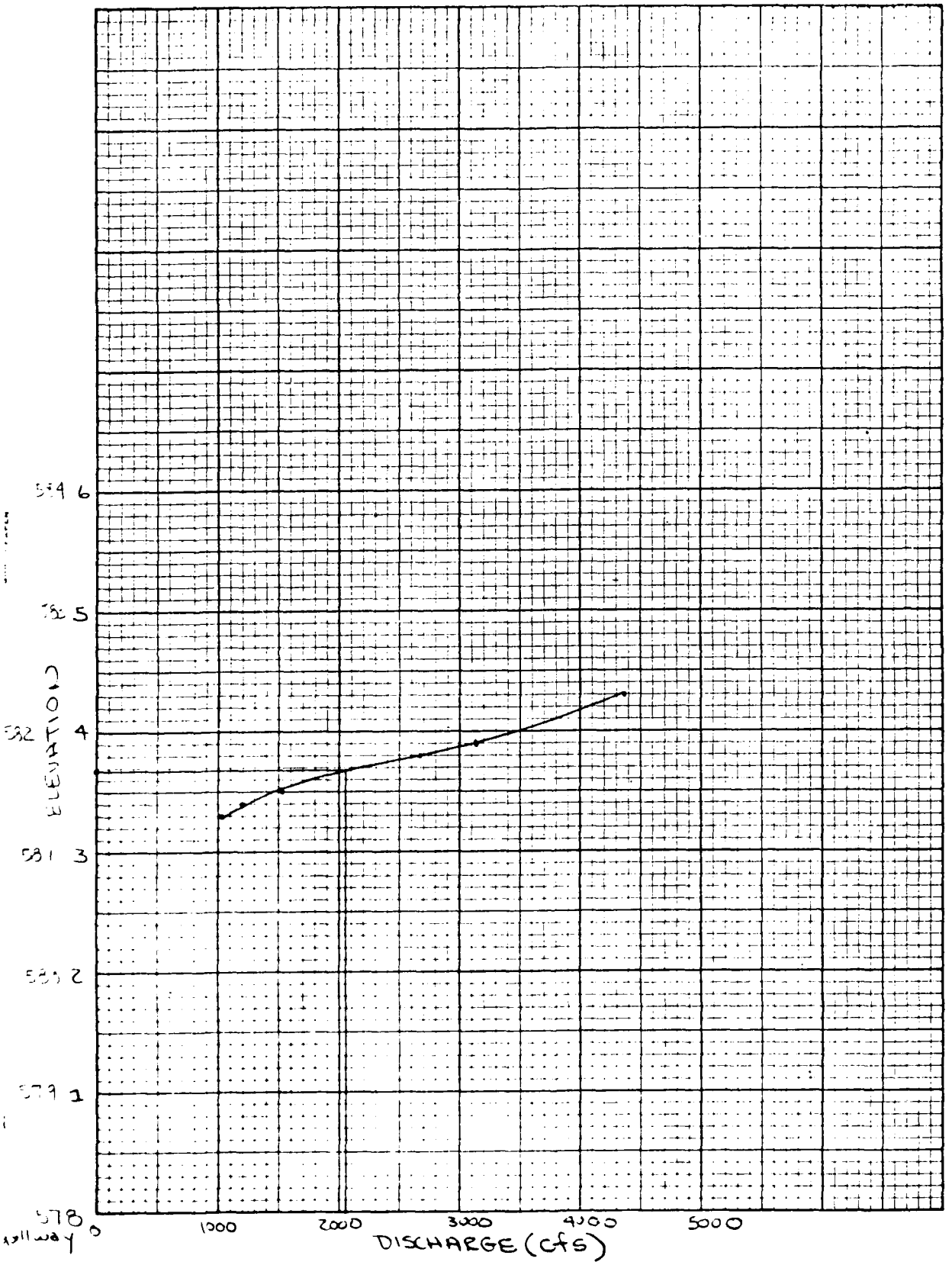
@ Surcharge Height to pass Q_{P2} of 1510 cfs

7.25×10^7 ft^3 = Volume

7.25×10^7 ft^3 $\times \frac{1}{5.58 \text{ mi}^2} \times \frac{1 \text{ mi}^2}{(5280)^2 \text{ ft}^2} = 0.73$ ft.

0.73 ft. $\times \frac{12 \text{ in}}{\text{ft}} = 8.7$" storage in inches of runoff

9/12 9/28/18 LTW



3b

STOR 1 = 9.6" runoff
STOR 2 = 8.7" runoff

Average = 9.15" runoff or 0.76'

$$0.76' \times \frac{3.58\ mi^2}{1} \times \frac{(5280)^2\ ft^2}{1\ mi^2} = 7.61 \times 10^7\ ft^3$$

REFER TO STORAGE VS. ELEVATION CURVE:

$7.61 \times 10^7\ ft^3$ reads ELEVATION = 581.68.

REFER TO ELEVATION VS DISCHARGE CURVE:

ELEVATION 581.68 = 2050 cfs

ELEVATION = 3.68' above spillway

PMF - spillway inadequate to handle PMF; Overtopping.

½ PMF - spillway inadequate to handle ½ PMF; Overtopping.

Subject D/S HAZARD ANALYSIS REVISED
Sheet No. 11 of 14
Date 2/14/78
Computed L. Williams
Checked
JOB NO. 3141-09 Pleasant Lake Dam

JARES IN. SCALE 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

D/S Hazard Analysis - using maximum pool elevation of 580 to determine breach discharge

Storage @ time of failure - 4215 AC-FT

Step 2. $Q_{p1} = \frac{8}{27} W_b \sqrt{g}\, y_o^{3/2}$

W_b = breach width

$g = 32.2\ ft/sec^2$

y_o = pool elev. → river bed

@ Pleasant Lake Dam

$W_b = 200'$

$g = 32.2\ ft/sec^2$

$y_o = 580 - 574$

$y_o = 6'$

From above equation: $Q = 4942$

Use the rating curve established from typical section of downstream reach (outlet to confluence with Northwood Lake) a distance of 1.3 miles). (See Page 13)

Q of 4942 - Stage 5.7'

Reach length - 6864'

Area @ 5.7' stage ≈ $1500\ ft^2 \approx 236$ AC-FT

$Q_{p2} = 4942\left(1 - \frac{236}{4215}\right)$

$= 4665$ cfs

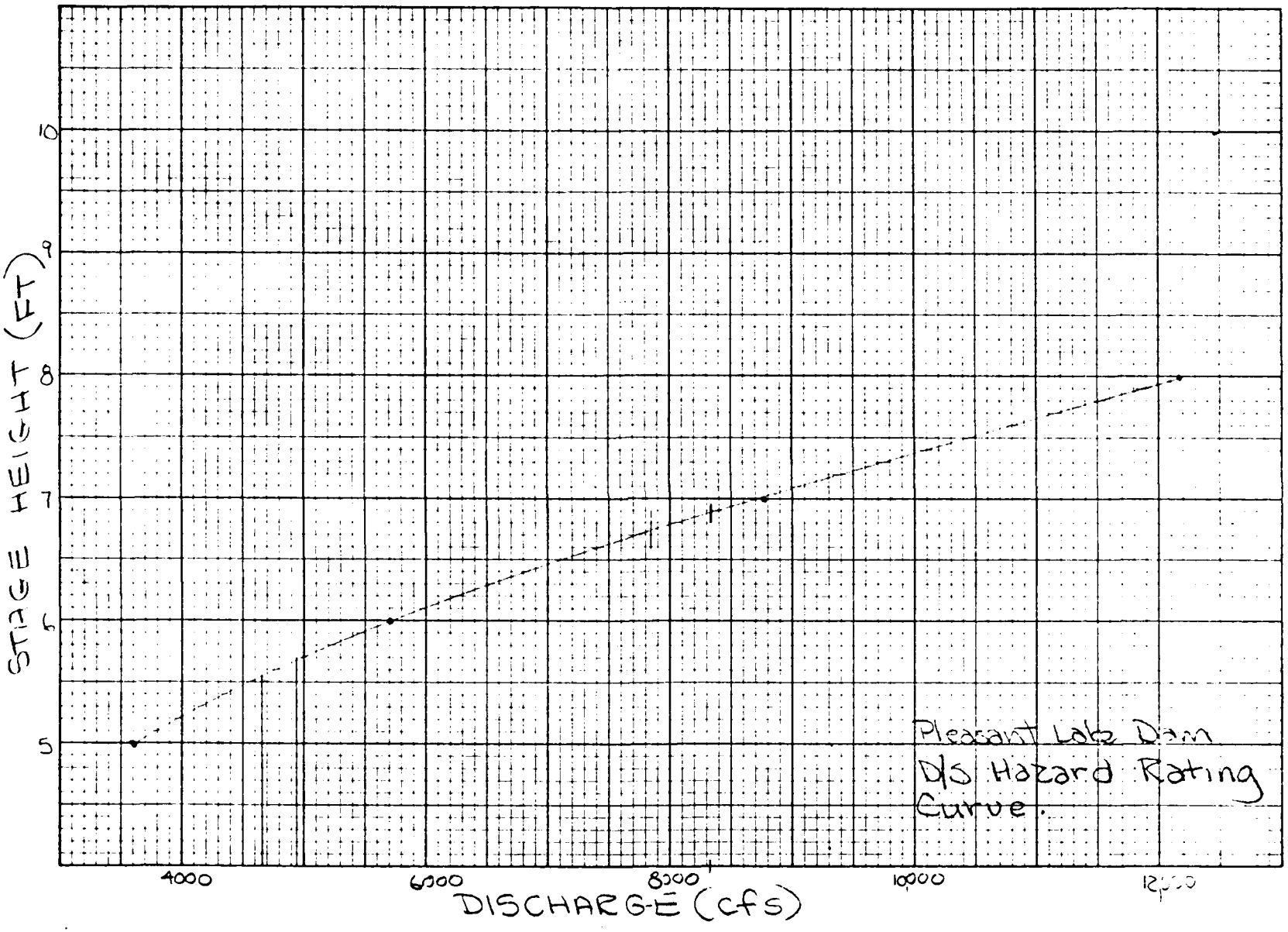
Stage = 5.55'

Area ≈ $1410\ ft^2 = 222$ AC-FT

$Q_{p2} = 4942\left(1 - \frac{229}{4215}\right)$

$= 4673$ cfs

Stage = 5.55' ≈ use 5.6' stage along downstream reach into Northwood Lake



Pleasant Lake Dam
D/S Hazard Rating
Curve.

D-13

12/21

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
NH	179	NED	NH	015	01				PLEASANT LAKE DAM	4312.1	7116.3	18	AUG	78

POPULAR NAME	NAME OF IMPOUNDMENT
	PLEASANT LAKE

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	04	TR-LITTLE SUNCOOK RIVER	EPSOM	4	1500

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	INSPECTION DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REERCTPG	1921	R	11	10	4215	3240	NED	N	N	N	N	10AUG78

REMARKS

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	1180	C	3	85	26000											

OWNER	ENGINEERING BY	CONSTRUCTION BY
TOWN OF DEERFIELD, N.H.		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NH WATER RES BD	NHWRB	NHWRB	NHWRB

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
ANDERSON-NICHOLS & COMPANY INC	31	MAY	78	PL 92-367

REMARKS

END

FILMED

7-85

DTIC